Ninth Annual Conference

Ecological Restoration Assessment & Monitoring

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Maritime Institute
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Conference Abstracts

Stony Run Geomorphological Monitoring Study

Drew Altland (STV, Inc) and Bill Stack (City of Baltimore, DPW)

ABSTRACT: In support of a Municipal Stormwater Permit for the City of Baltimore's Department of Public Works – Water Quality Management Section, STV has performed a geomorphological monitoring study for Stony Run, a tributary to the Jones Falls, as part of a comprehensive watershed management plan. The Stony Run (3.3 square mile) watershed is located in the highly urbanized central region of Baltimore City, which has a computed impervious area of approximately 38%. The presentation will report the morphological changes in the stream channel over multiple time periods using monumented cross sections and bank pin data to compute the rate of erosion in tons per year. To determine the accuracy of the stability predictions using the Bank Erodibility Hazard Index and the Near Bank Shear Stress methodologies, comparisons of the predicted and measured erosion rates will be presented. In addition, sediment samples have been collected from the eroding stream banks at the monumented cross sections, so that the nutrient loads delivered to the Jones Falls can be estimated.

Assessing and Restoring Underwater Grasses

Peter Bergstrom (NOAA Chesapeake Bay Office)

ABSTRACT: Monitoring and assessment play several key roles in the restoration of underwater bay grasses. First, recent and historical monitoring of the locations and sizes of underwater grass beds are needed to identify areas in need of restoration. Recent and historical distribution by species is very useful if it is available, since it aids in species selection. Second, recent water quality monitoring data from near the potential planting sites are needed to identify sites that currently lack underwater grasses, that may be able to support restored beds. Ideally this monitoring should continue throughout the restoration process, to help understand planting success or failure. Third, small test plantings should be done and their survival assessed for at least a year to identify specific planting locations. Finally, the survival of any planted beds needs to be assessed often enough and long enough (at least two years) to identify likely causes of failure if this occurs.

Placing Water Quality Monitoring within the Framework of Ecological Restoration

Keith Bowers (Biohabitats, Inc. and incoming Chairman for The Society for Ecological Restoration International)

ABSTRACT: Water quality monitoring is increasingly becoming a component of much larger and more complex land management initiatives. Typically these initiatives involve the restoration of wetlands, rivers and riparian corridors. Restoring ecosystems can be a complex and multifaceted undertaking, taking in a host of factors and a large matrix of possibilities. How then does water quality monitoring fit within the overall context of ecological restoration?

Over the past twelve years The Society for Ecological Restoration International (SER International) has developed two documents that serve as a starting point for defining restoration and providing a framework on which to base water quality monitoring. The SER Primer on Ecological Restoration and the Guidelines for Developing and Managing Ecological Restoration Projects provide a solid, scientific and widely accepted foundation for ecological restoration. These two documents and their relevance to water quality monitoring will be discussed.

New Methods for Urban Stream Restoration Assessment and Monitoring

Ted Brown (Center for Watershed Protection, Ellicott City, MD)

ABSTRACT: This paper focuses on new guidance developed by the Center for Watershed Protection detailing a systematic assessment of potential restoration opportunities within the stream corridor and subwatershed known as the Unified Stream Assessment (USA) and the Unified Subwatershed and Site Reconnaissance (USSR). The USA is a rapid assessment of all surface drainage in a subwatershed to identify problems and opportunities within the stream corridor. The USA evaluates eight stream impacts or conditions, including storm water outfalls, severe erosion, impacted buffers, sewer lines, stream crossings, channel modifications, dumping and miscellaneous impacts. The USSR explores pollution sources and restoration opportunities that exist in upland areas of the subwatershed. The USSR is essentially a windshield survey that profiles current practices in residential, commercial, industrial and municipal areas; the condition of streets and storm drains; the potential for on-site retrofits; and confirms the location of storm water hotspots and industrial storm water discharges. Together, these assessment methods provide watershed managers with a comprehensive picture of subwatershed conditions and the restoration options available. This information becomes the building blocks of the small urban watershed restoration strategy.

Living Shoreline Treatments and the Need for Monitoring and Assessment

David Burke (Burke Associates)

ABSTRACT: The Keith Campbell Foundation for the Environment and several cooperating entities are involved in a Living Shorelines Stewardship Initiative designed to increase living resources on private properties surrounding the Bay. "Living shoreline" treatments can be used to reduce sediment and nutrients by stabilizing shorelines in low and medium wave energy areas and to establish vital habitats that help sustain or enhance a variety of plant communities and living resources found at the water's edge. These naturalized shoreline treatments emphasize the use of techniques such as: marsh plantings; supplementary beach nourishment; sill and breakwater control with added SAV and oyster enhancement; and other combinations of strategically placed structural and organic materials.

Experimentation and innovations in living shoreline treatments is proceeding at a rapid rate, yet documentation of the successes and failures of these applications is scant. Older non-structural projects and recent innovative treatments need to be monitored and assessed to document changes in the structural integrity of alternative designs, biological conditions, water quality and shoreline dynamics. Baseline and customized monitoring protocols will be developed within the scope of the Living Shorelines Stewardship Initiative to help identify effective living shoreline treatments and appropriate site suitability criteria.

Grassroots Restoration of the Anacostia River

Jim Connolly (Anacostia Watershed Society)

ABSTRACT: The Anacostia River watershed encompasses portions of Montgomery and Prince George's Counties and the District of Columbia. This 176 square mile watershed is urban in nature, with portions being over 50% impervious. It is plagued by typical urban pollutants, such as sediment, toxics, nutrients, trash and sewage, mostly associated with stormwater impacts from its impervious areas. The Anacostia Watershed Society (AWS) is a local, non-profit environmental organization that is working to restore the river to a swimmable and fishable condition. Working with thousands of volunteers and school groups, AWS has planted over 11,000 trees throughout the watershed, removed over 478 tons of trash and 7,500 tires from the river, established native Wild Rice and other emergent plants in the river's wetlands, and restored two sections of severely eroded streambank on the Northwest Branch tributary, all with minimal resources, and with maximum effectiveness. This talk will highlight the grassroots approach AWS has employed to bring hope back to the Anacostia River, with particular emphasis on low-tech approaches.

Nutrient Transport to Surface and Groundwater on the Delmarva Peninsula

Judy Denver (USGS)

ABSTRACT: Nutrients move readily from application areas through both ground water and surface runoff to streams on the Delmarva Peninsula. Ground water discharged from the surficial aquifer is the primary source of nitrate in streams, whereas phosphorus is primarily contributed to streams through overland runoff during storms. The median concentration of nitrate in ground water in the surficial aquifer is about 5 mg/L as nitrogen; nitrate concentrations are greater than 3 mg/L as nitrogen in about half of the headwater streams on the Peninsula during base-flow conditions in the spring. Concentrations of phosphorus are typically below 0.1 mg/L in ground water and in most streams during spring base-flow conditions, and can increase to greater than 1 mg/L in runoff during storms.

The processes that control the movement of nutrients to ground water and streams are related to local variability in hydrologic and geochemical conditions determined by landscape, soil, and geology. In well-drained watersheds overlying thick sandy aquifers with incised streams (such as those in Kent County, Maryland) nitrate is preferentially transported as a dissolved ion through ground water to streams. Less soluble nutrients move primarily through physical transport processes in runoff. In contrast, in flat poorly drained watersheds underlain by a thin surficial aquifer, such as the upper Pocomoke River Basin in Wicomico and Worcester Counties, Maryland, surface runoff is limited to particularly significant precipitation events. Ground-water discharge from the surficial aquifer and an underlying partially confined aquifer is the most important factor controlling stream chemistry in this area.

Nutrient Fate and Transport Associated with Poultry Litter Stock Piles

Gary Felton (University of Maryland, CES)

ABSTRACT: The effects of poultry litter stockpiles on nutrient availability and movement were evaluated for the major poultry producing regions in Maryland. The effect of covering stockpiles with tarps was compared to uncovered piles. An upland Coastal Plain soil and a lowland Coastal Plain soil were used. Surface runoff was captured and nutrient analysis was done. Subsurface flow was sampled for nutrient content. In runoff water, covering piles resulted in a 9% reduction in nitrate on a sandy soil, but had no advantage on a silty clay loam. Orthophosphate concentrations were reduced by a factor of 47 on the sandy loam soil but were again unaffected on the silt clay loam soil. Uniformly, covering plots reduced the nitrate concentration in soil water beneath the plots, regardless of soil type. However, when piles were removed, all concentrations converged (with time) to the uncovered levels.

Techniques for Monitoring and Assessing Social and Ecological Dynamics in Watershed 263

Guy Hager (Director, Parks & People Foundation), Ken Belt (Hydrology Research, US Forest Service and Baltimore Ecosystem Study) and Morgan Grove (Social Research, US Forest Service)

ABSTRACT: Watershed 263 is a new, innovative public-private partnership project to prepare and implement a model urban storm sewer Watershed Management Plan as an official Baltimore City guide for restoration. Through collaboration among several organizations with various expertises the project will collect evaluation and research data and develop methods and tools for decision-making and management in order to improve the quality of urban land and water resources contributing to urban revitalization. The social and ecological data to be collected and monitored over time will range form vegetation health, water quality, quality of life indicators and more.

Prioritization of Howard County Watersheds for Preservation or Restoration

Hunt Loftin (TetraTech, Inc.)

ABSTRACT: Howard County developed a screening and ranking process that provides a publicly and politically defensible framework for developing and implementing a program for the preservation or restoration of all County subwatersheds. The program addresses the Maryland Department of the Environment's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit requirements to select a watershed area for restoration that contains at least ten percent of the County's impervious area. Howard County's screening and ranking process makes use of existing geographic information system (GIS) coverage for existing and future land use, topography, and stream network as well as information gathering from NPDES and other environmental studies. The process supports the County's actions to meet NPDES MS4 permit requirements as well as develop long-term countywide watershed management plans. The process is transferable and easily modified to meet the requirements of other jurisdictions

The Effect of Nutrient Management and Cover Crops on Water Quality in Green Run

John McCoy (Maryland Department of Natural Resources). J. L. McCoy, M. Sigrist, and J. Jaber

ABSTRACT: The Pocomoke River, located on the Eastern Shore of Maryland, is one of four major tributaries of the Chesapeake Bay. In 1994, the Wicomico Soil Conservation District (SCD) invited Maryland Department of Natural Resources (MD DNR) and United States Geological Survey (USGS) to join in a project demonstrating the effect of nutrient and poultry litter management on water quality. The project is designed as a paired watershed experiment. The north fork of Green Run was selected as the control watershed and the south fork of Green Run the treatment watershed. The 2,342-acre control watershed contains 58% cropland and 42% woodland land usage, and an annual chicken production (broiler) capacity of 3,493,000. The 1,779-acre treatment watershed is 54% cropland and 46% woodland with an annual broiler production capacity of 1,400,000.

Net surpluses of nitrogen (N) and phosphorous (P) applied to cropland during the calibration period (1994-1998) averaged 152 lbs/acre and 42 lbs/acre, respectively, in the control watershed. The treatment watershed averaged 143 lbs/acre and 52 lbs/acre, respectively, during the calibration period. N and P yields from the watersheds during the calibration period averaged 11.59 lbs/acre/yr and 0.81 lbs/acre/yr, respectively, from the control watershed, and 20.15 lbs/acre/yr and 3.17 lbs/acre/yr, respectively, from the treatment watershed.

The treatment program that began in 1998 consists of complete poultry litter removal and replacement with recommended rates of inorganic fertilizer, as well as growing cover crops on all available cropland in the treatment watershed. Nutrient budgets indicate that nutrient surpluses in the control watershed have remained constant, while nutrient surpluses in the treatment watershed have decreased 92% for N and 98% for P. Water quality results indicate that the

treatment program has resulted in a 27% decrease in total nitrogen concentrations being discharged from the treatment watershed

Principles for Managing Agricultural Nitrogen

John J. Meisinger (Soil Scientist, USDA-ARS, Beltsville, MD)

ABSTRACT: Managing agricultural nitrogen (N) to minimize N losses is a challenge to nutrient managers who must develop nutrient management plans that consider rate and application strategies that account for hydrology, soil properties, and crop-tillage systems of a specific site. Ammonia losses are becoming a renewed concern, which can be managed by soil incorporation. Nitrogen leaching is a significant loss, with leaching events occurring when soil nitrate concentrations are high and water is moving through the soil profile. The universal tools for managing N leaching include understanding the soil-crop-hydrologic cycle because hydrology drives N losses, avoiding excess N applications because excess N is most vulnerable to loss, and applying N in-phase with crop demand because this increases crop N recoveries. Cropping system tools for managing leaching include use of grass cover crops, and adding a legume or deep-rooted crop to a rotation. Other approaches include use of riparian zones and conservation reserve program areas. Site monitoring tools such as the pre-sidedress soil nitrate test, and the leaf chlorophyll meter are useful in identifying N sufficient sites and avoiding excess N rates. Real-time monitoring techniques, combined with variable rate N applicators, offer new opportunities for improving N management . The application of the above N management tools to fields, or specific management areas within a field, will improve crop N recoveries with subsequent reductions in N losses to the environment.

Submerged Aquatic Vegetation Restoration in Chesapeake Bay

Mike Naylor (Maryland Department of Natural Resources)

ABSTRACT: Research, monitoring and implementation projects over the past 30 years have demonstrated that submerged aquatic vegetation (SAV) is one of the most important biological communities in the Chesapeake Bay. The bay states have committed significant resources during this period to determine the causes for the greatly reduced SAV populations in the Bay and its tributaries, to set new restoration baselines, and to identify the most appropriate methods for protecting and restoring SAV populations. A formal Restoration Strategy has been developed to build a consensus among the partners of the Chesapeake Bay Program to determine how best to accelerate the restoration of the bay's SAV. Building on the results of past transplanting, and using the guidance of the Restoration Strategy, several of the largest SAV restoration projects ever undertaken on the East Coast are now underway. A great diversity of assessment and monitoring tools and methods are being used to insure that no matter the results of each individual activity, large strides will be made in understanding the success or failure of restoration activities.

Tidal Wetland Restoration Through Small Scale Use of Dredged Material

David Nemerson (National Aquarium in Baltimore)

ABSTRACT: The National Aquarium in Baltimore (Aquarium) and its partners have been developing a cooperative program to restore tidal wetlands in the Chesapeake Bay and develop a community-based infrastructure for long-term, science-based monitoring. Partners include NOAA, USFWS, USACE, state and local governments and community groups. Using dredged material, marshes are created on the exposed shores of eroding islands. The Aquarium mobilizes and trains volunteers to plant and monitor the sites. Given their location on high-energy shores, the sites' physical stability and performance of protective structures are key attributes. One four-hectare site created behind geotubes has displayed excellent stability; loss in elevation is due to dewatering and compaction, not erosion. Plants are doing well and are beginning to coalesce. Resident animal species are abundant and reproducing. Long-term stability remains unknown due to possible geotube failure and resulting erosion. At a one-hectare site placed behind riprap, marsh establishment is also proceeding. Vegetation is doing well and coalescing. The site remains dynamic; sediment is accreting behind the riprap and eroding behind the openings. Other sites are displaying similar results. While early in development, results show this model has the potential to produce high quality marsh habitat, create important citizen commitment to stewardship, and provide a useful infrastructure for long-term monitoring.

Monitoring Restoration of the Agricultural Component of Coastal Plain Watersheds

Ken Staver (University of Maryland, Wye Research and Education Center)

ABSTRACT: Committing major land resources to food production is essential to the sustainability of modern civilization. In the mid-Atlantic Coastal Plain, soil and climatic factors are favorable for production of the primary grains that are the backbone of our current food production system. As a result, grain production is the dominant land use in many Coastal Plain watersheds. In the last several decades it has become apparent that estuaries associated with many of these watersheds are severely impacted by excessive nutrient loads from agricultural areas.

Most strategies for restoring coastal estuaries seek major reductions in nutrient loads from agricultural activities. While quantifying the effects of modifications in agricultural practices on nutrient losses is straightforward in small-scale experiments, measuring effects of implementation at larger-scales in mixed land use watersheds is much more difficult. The tendency to put all available resources toward implementation usually leaves minimal resources for monitoring the effects of implementation efforts on nutrient loads. Little monitoring would be needed if there were a high degree of certainty regarding the effectiveness of the practices being implemented. Unfortunately, the history of nutrient control efforts is relatively brief and the scientific underpinning is very limited, even at the experimental scale, regarding the effectiveness of many of the practices that are being implemented. Effectively monitoring progress toward meeting nutrient reduction goals with minimal resources will require consideration of the spatial and temporal dynamics of nutrient transport.

Reductions of both nitrogen (N) and phosphorus (P) loads from cropland are being sought in most estuarine restoration efforts. Although to some extent, N and P both move in all discharge from cropland, their behavior in soils, and primary pathways of transport are very different. Monitoring strategies need to be tailored to account for these differences. Phosphorus is transported primarily in overland flow generated for brief periods in close association with intense precipitation. A limited number of large events can dominate P loads in small watersheds on an annual basis or even across much longer time frames. A further complicating factor is that stream flow always includes base flow even during storm events, thus dampening changes in P concentrations in storm flow. Characterizing P losses requires rigorous storm event-based monitoring for long periods, and extreme natural variability will tend to make detection of modest reductions in P transport difficult. In the Coastal Plain, N loads from cropland tend to be dominated by nitrate transport through subsurface flow paths that discharge into streams or directly into tidal waters. Stream base flow nitrate concentrations provide an integrated estimate of watershed subsurface nitrate concentrations along with the effects of riparian and in-stream processes that retain nitrate. Much less rigorous monitoring strategies are needed to characterize watershed N loads on an annual basis. However, stream base flow is comprised of subsurface discharge ranging in age from months to decades, depending on watershed hydrogeology. Consideration of the temporal relationship between root zone nitrate leaching and stream base flow is essential if changes in stream N loads are to be correctly related to implementation activities.

Restoration Monitoring at Multiple Scales - Baltimore County Perspective

Steve Stewart (Baltimore County Department of Environmental Programs)

ABSTRACT: Baltimore County has developed a monitoring approach to watershed restoration at multiple scales. This approach provides project specific measures of restoration success and watershed restoration progress. The approach includes chemical, physical and biological measures of aquatic system improvement. In addition, research projects have been focused on areas where there is insufficient information on restoration effects. All stream restoration projects are monitored for post restoration stream stability through permanent cross sections and a subset are selected for biological and chemical monitoring. Monitoring on an eight-digit watershed scale includes, random point selection macroinvertebrate biological monitoring, targeted baseflow monitoring and storm event monitoring at USGS gages. Data from these programs will allow a trend analysis at the eight-digit watershed scale over time.

Completed research projects include storm event pollutant load reduction due to stream restoration and the effectiveness of urban riparian buffers in providing a variety of ecosystem services. Current research projects include pollutant removal efficiency of a storm drain cleaning program; the effectiveness of the new Stormwater Design Manual criteria in the protection of stream channels and the biotic community and changes in stream chemistry; and the pollutant removal efficiency of bioretention facilities.

Future monitoring efforts will be directed at the intermediate subwatershed scale as restoration Action Plans are completed over the next six years.

Growing Role of Monitoring and Monitoring Councils in America's Water Programs

Chuck Spooner (US Environmental Protection Agency, Office of Water)

ABSTRACT: EPA recognizes that water monitoring is a key ingredient of information-based environmental protection and the Office of Water has identified improved monitoring as among its highest priorities. State and regional water monitoring councils have become an important vehicle for promoting collaborative efforts, exploring new and emerging technologies, addressing changing expectations of monitoring, ensuring data and information comparability, and sharing results and successes. This presentation will discuss the role and growth of state and regional monitoring councils in America's water programs.

Overview of Assessing and Restoring Maryland's Tidal Environments and Oyster Populations

Rich Takacs (Mid-Atlantic Restoration Coordinator, NOAA Restoration Center)

ABSTRACT: Federal and state agencies, and environmental organizations have long been involved in monitoring and assessing resources to gage their "status". Recently, this has evolved into a more proactive role in the resource status, by coupling active restoration with monitoring and assessment. Specific engagement of citizens and watershed groups through "community-based Restoration Programs" has fostered additional awareness, support, and funding for restoration activities. Along with and in partnership with a number of other similar programs, NOAA's Community-Based Restoration Program has grown from a $100K effort in 1997, to a $12M effort with dedicated restoration staff located throughout the country.

In the Chesapeake Bay, over 80 projects have been completed, and technical expertise and funding supports projects including tidal wetlands and island restoration, submerged aquatic vegetation restoration, fish blockage removal and shellfish restoration. The oyster has long played an important role in the economy and ecology of the Chesapeake Bay, and attempts to restore or enhance their abundance have occurred for nearly as long as the fishery for them has existed. Recognition of the water quality benefits that these filter feeders can produce, to the habitat architecture role that these reef builders fill, to the ecosystem role that these reefs provide, has resulted in widespread support for restoring oyster beds and reefs. Much of the large-scale restoration underway drew its initial methods, science, and support from citizen-based restoration activities, which continue in parallel with the larger efforts even today.